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Improving dielectric permittivity by incorporating PDMS-PEG block copolymer into PDMS network

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Polydimethylsiloxane (PDMS) based elastomers are well-known to actuate with large strain mainly due to their low modulus and their non-conducting nature. On the other hand, polyethyleneglycols (PEG) are not stretchable but they have high permittivity and are conductive. Combination of the two polymers as a block copolymer depicts a possibility for substantial improvement of properties such as high permittivity and non-conductivity – if carefully designed. The objective is to synthesize PDMS-PEG multiblock copolymer assembling into different morphologies¹ such as lamellar, cylinder, gyroid and spheres based on variation of volume fractions of PDMS and PEG. The synthesis is amended from Klasner et al.² and Jukarainen et al.³ Variation in the ratio between the two constituents introduces distinctive properties in terms of dielectric permittivity and rheological behaviour. PDMS-PEG multiblock copolymer-based elastomers of different volume fractions exhibit high storage permittivity but they are conductive. By incorporating conductive PDMS7-PEG multiblock copolymers into a commercial non-conductive PDMS elastomer (MJK) creates a promising morphology which enhances storage permittivity (ϵ') by 60% with 5wt% of PDMS7-PEG block copolymer incorporated in the PDMS network.

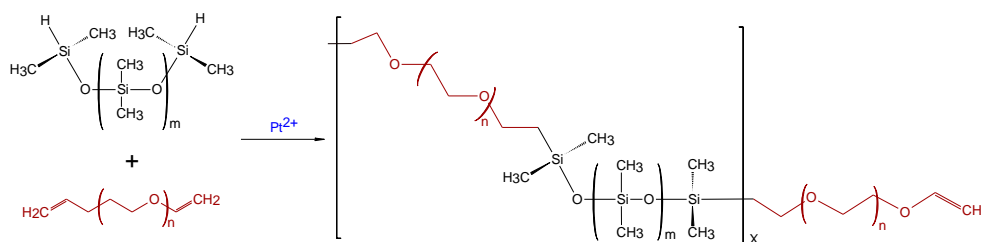


Fig. 1: Hydrosilylation reaction of PDMS-PEG multiblock copolymer with presence of platinum catalyst

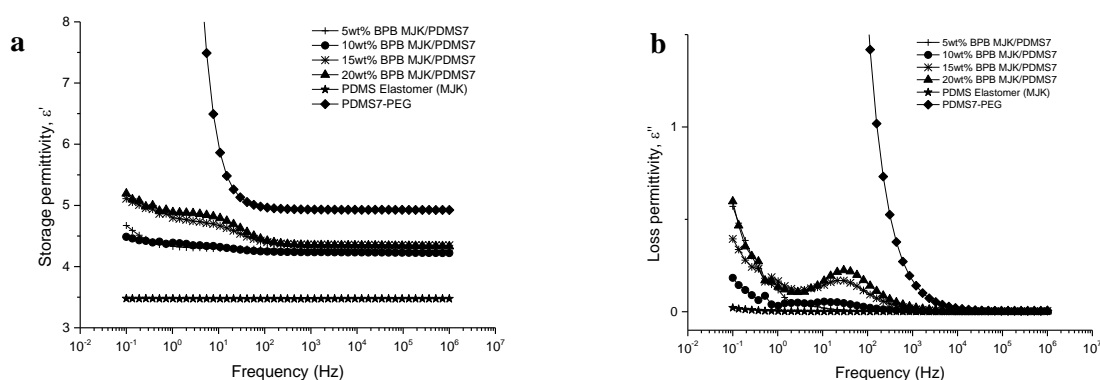


Fig. 2: Dielectric properties of samples a) Storage permittivity and b) Loss permittivity at 23 °C.

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